

ARJUNA



JEE

LECTURE - 12

Mole Concept



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Q. Molality of aqueous solution of $\text{Ca}_3(\text{PO}_4)_2$ is 0.6m. Calculate the molality of phosphate ions (PO_4^{-3}) $(\text{PO}_4^{-3})_2$

A 1.2m → 51%

B 0.6m

C 2.4m

D 1.8m

$A_xB_y \rightarrow \text{molality} = m$

$\text{molality of } A^{+y} = x \times \text{molality of } A_xB_y$

$= x \times m$

$= 2 \times 0.6 = 1.2m$



Q.

A solution of sodium sulphate contains 92 g of Na^+ ions per kilogram of water.
 The molality of Na^+ ions in that solution in mol kg^{-1} is (Jee-Main 2019)

[A] 16

[C] 132

solvent = 1 Kg
 $\text{Na}^+ = 92 \text{ gram}$

[B] 4

[D] 8

wrong hai
 molality of $\text{Na}_2\text{SO}_4 = 4\text{m}$
 molality of $\text{Na}^+ = 2 \times 4$

$$\text{molality of } \text{Na}^+ = \frac{\text{mole of } \text{Na}^+}{\text{Mass of water (Kg)}}$$

$$= \frac{\frac{92}{23}}{1} = 4\text{m}$$



Molarity

total mole of solute dissolved in 1 litre or 1000ml or 1dm^3 of solution

Ex $\rightarrow$ 2 mole NaOH present in 500ml of solution

Calculate molarity of solution = $2 \times 2 = 4\text{M}$



$$\rightarrow \text{Molarity (M)} = \frac{\text{mole of solute}}{\text{Volume of solution (litre)}}$$

$$\rightarrow M = \frac{\text{mole of solute}}{\text{Vol. of sol}^n \text{ (ml)}} \times 10^3 \rightarrow \text{sahi hai}$$

$$\rightarrow \text{Unit of M} = \frac{\text{mole}}{\text{litre}} \text{ or } M$$

$$M = \frac{(\text{mole})_{\text{solute}}}{\frac{\text{Vol. of sol}^n \text{ (ml)}}{10^3}}$$

$$M = \frac{(\text{mole})_{\text{solute}} \times 10^3}{\text{Vol. of sol}^n \text{ (ml)}}$$

$$\underline{C_{SD} = 36}$$

$$(1) \text{ Molarity (M)} = \frac{\text{Mole of solute}}{\text{Vol. of sol}^n (\text{litre})}$$

$$(2) \text{ Molarity (M)} = \frac{\text{Mole of solute} \times 10^3}{\text{Vol. of sol}^n (\text{ml})}$$

$$(3) \begin{array}{l} \text{solute-solid} \\ \text{solvent-liquid} \end{array} \left\{ \begin{array}{l} \text{Vol. of solvent} = \text{Vol. of sol}^n \end{array} \right.$$

$$(4) \text{ No. of mole of solute} = \text{Molarity} \times (\text{Vol})_{\text{sol}^n} (\text{litre})$$

$$\text{No. of mole of solute} = M \times V$$

(5) Molarity in term % (w/v)

x % (w/v)

mass of solute = x gram

Vol. of solⁿ = 100 ml

$$\text{Vol. of sol}^n = \frac{M}{d} = \frac{100}{d} \text{ ml}$$

$$M = \frac{\frac{x}{\text{M.wt}} \times 10^3}{\frac{100}{d} \text{ ml}}$$

$$M = \frac{x \times d \times 10}{\text{M.wt.}}$$

(6) Molarity in term of % (w/w) → density Questⁿ me given
hoga (d g/ml)

x % (w/w) → mass percentage

mass of solute = x gram

mass of solⁿ = 100 gram

Q Calculate the molarity of $\underbrace{20\%}_{\text{solute}} \cdot \overbrace{(\text{w/v})}^{\text{sol}^n}$ aqueous solution of NaOH.

(a) 0.2 M

(b) 0.02 M

(c) 0.5 M

(d) 0.05 M

☒ (e) None of these

$$\begin{aligned}\text{Molarity (M)} &= \frac{\text{mole of NaOH} \times 10^3}{\text{vol. of sol}^n (\text{ml})} \\ &= \frac{20/40 \times 10^3}{100} \\ &= \frac{20^5}{40 \times 100} \\ &= 5 \text{ M}\end{aligned}$$

Q 5.85 gram NaCl dissolved in 500 ml of water
Calculate molarity of solution (Na=23, Cl=35.5)

(a) 0.1 M

☒ (b) 0.2 M

(c) 0.3 M

(d) 0.4 M

$$\text{Molarity (M)} = \frac{\text{Mole of solute} \times 10^3}{\text{Vol. of soln. (ml)}}$$

$$= \frac{5.85 \mid 58.5}{500} \times 10^3$$

$$= \underline{0.1} \times 2$$

$$= \underline{0.2 \text{ M}}$$

Q 0.2M, 3 litre solution of NaCl present in a container.

Calculate amount of NaCl in solution

☒ (a) $6 \times 58.5 \text{ gram}$

(b) $0.6 \times 58.5 \text{ gram}$

(c) $6 \times 58.5 \text{ gram}$

(d) 58.5 gram

Mole of NaCl = $0.2 \times 3 = 0.6 \text{ mole}$

amount of NaCl = $0.6 \times 58.5 \text{ gram}$
or
 $= 6 \times 58.5 \text{ gram}$

Q 500 ml solution of glucose present in Container and molarity of glucose solution is 0.4 M.

Calculate mole of glucose in solution

(a) $0.8 \times 180 \text{ gram}$

(b) $0.4 \times 180 \text{ gram}$

(c) 0.4 mole

(d) 0.2 mole ✓✓

$$\text{mole of glucose} = M \times V (\text{litre})$$

$$= 0.4 \times 500 \times 10^{-3} \text{ litre}$$

$$= 0.4 \times \frac{1}{2}$$

$$= \underline{\underline{0.2 \text{ mole}}}$$

Q. Dissolving 120 g of urea (mol. wt. 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is [IIT-JEE 2011]

A 1.78 M

B 2.00 M

C 2.05 M ✓

D 2.22 M

$$d = \frac{m}{V}$$

$$V_{\text{sol}} = \frac{m_{\text{sol}}}{d_{\text{sol}}}$$

$$= \frac{(1000 + 120)}{1.15} \text{ ml}$$

$$= \frac{1120}{1.15} \text{ ml}$$

$$M = \frac{\text{mole of solute} \times 10^3}{\text{Vol. of sol. (ml)}}$$

$$= \frac{120/60 \times 10^3}{\frac{1120}{1.15}} = \frac{20 \times 1.15 \times 1000}{1120} = 2.0517$$



Q.

3.0 g of a salt of molecular weight 30 is dissolved in 250 g water
($d = 1 \text{ g/ml}$). The molarity of the solution is _____

(IIT-JEE 1983)

(M-1)

$$M = \frac{\text{mole of solute} \times 10^3}{\text{Vol. of sol}^n}$$

$$= \frac{3/30 \times 10^3}{250}$$

$$= \frac{\cancel{3} \times \cancel{1000}^2}{\cancel{30} \times \cancel{250}^2}$$

$$= \frac{2}{5} = \underline{\underline{0.4}}$$

$$V = \frac{M}{d} = \frac{250}{1} \text{ ml}$$

$$\text{Mass of sol}^n = (250 + 3) \text{ gram}$$

$$= 253 \text{ gram}$$

$$\text{Vol. of sol}^n = 253 \text{ ml}$$

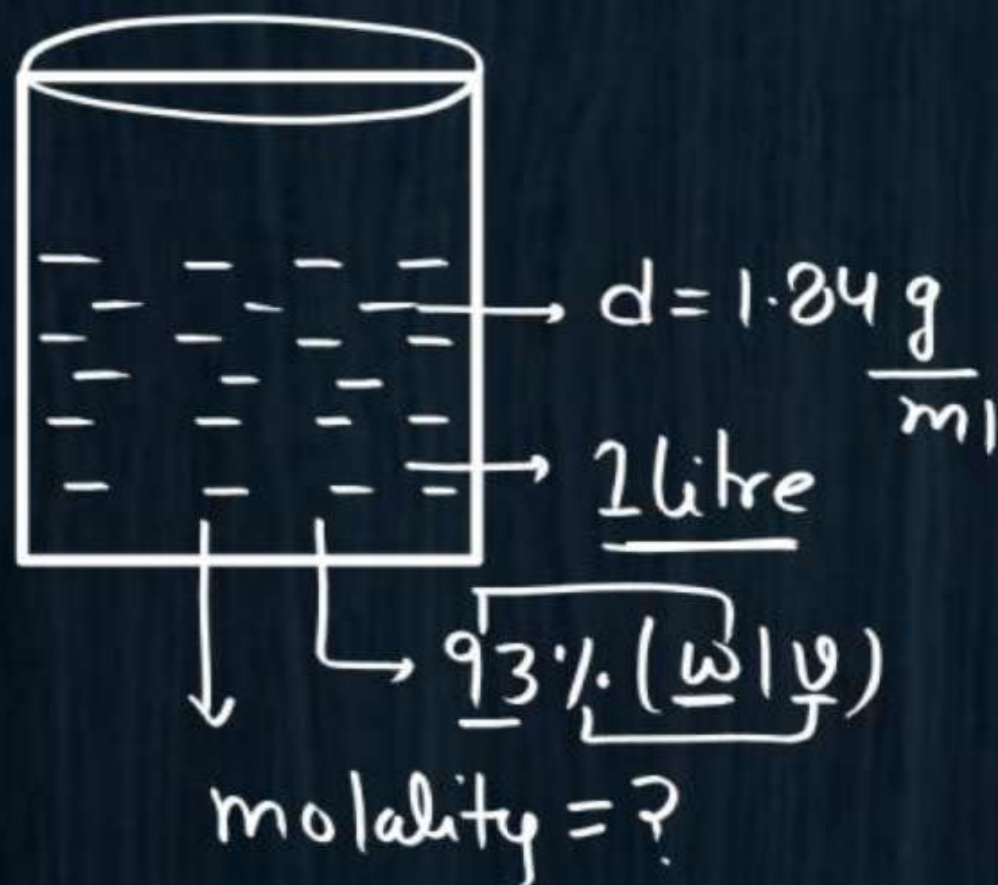
(M-2)

$$M = \frac{3/30 \times 10^3}{253}$$

$$= \frac{\cancel{3} \times \cancel{1000}}{\cancel{30} \times 253} = \frac{100}{253} = 0.395 \approx \underline{\underline{0.4}}$$

Q.

Calculate the molality of 1.0 L solution of 93% H_2SO_4 , ~~by weight~~. The density of the solution is 1.84 g/mL. **(IIT-JEE 1990)**



100ml — 93 gram

1000ml — 930 gram

mass of soln = $1.84 \times 1000 = 1840 \text{ gram}$

$$\begin{aligned}
 \text{molality} &= \frac{\text{mole of solute} \times 10^3}{\text{mass of solvent (gram)}} \\
 &= \frac{930 / 98 \times 1000}{(1840 - 930) \text{ gram}} \\
 &= \frac{930 \times 1000}{98 \times 910} \\
 &= 10.4
 \end{aligned}$$

$$\underline{C_{SD} = 37}$$



Suppose $\rightarrow$ Molarity of $A_x B_y$ molecule = M

$$\text{Molarity of } A^{+y} = x \times \text{Molarity of } A_x B_y = x \times M$$

$$\text{Molarity of } B^{-x} = y \times \text{Molarity of } A_x B_y = y \times M$$

Q. Molarity of aqueous solution of $\text{Zn}_3(\text{PO}_4)_2$ is 0.6M. Calculate the molarity of Zn^{+2} ions

A 1.2M

C 2.4M

B 0.6M

✓ D 1.8M

Ans batao



Home work

DPP-NO = 8 → nahi krni hai aaj.



PW Maharathi

Because Practice makes a Maharathi

You have a TEST !!!

Rewards for Students who attempt all the tests regularly on Sunday/ Monday!

- Top 3 Students in each month will receive a Gift Voucher worth Rs 500.
- Top 20 Students in each month will receive a Gift Voucher worth Rs 200.
- Lucky 20 students in each month will be selected on a random basis who will receive a Gift Voucher worth Rs 100 for attending regular tests.
- All the students attempting regular tests will be eligible for Live Teacher Interaction-Paramarsh(2.0)

MEGA MAHARATHI (Oct-2022 & Feb- 2022)

- Top 5 Students will receive a Gift Voucher worth Rs 1000
- Lucky 100 Students in Oct 2022 & Feb 2023 will be given a Gift Voucher worth Rs 500 under MEGA MAHARATHI.

** Eligibility and Rules are covered in the next slide.

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DO's AND DON'Ts TO BECOME A PW MAHARATHI:-

- 1). You have to **attempt all the test** occurring between the last Maharathi and till the next one to be eligible for Maharathi at all.
- 2). Maharathi will be announced only in the batch for the month if more than one test has occurred in that last month. For eg- If only one test occurred in June then that test would be considered in July's Month Maharathi Results.
- 3). The **combined performance of all the tests** would ensure your selection in the **toppers prizes**.
- 4). The selection of **Lucky students** will be done using our **Random Selection Algorithm** and not on the basis of marks, names and past maharathi results, you just have to be **eligible by attempting all tests** and yes, if you have been **selected once it can happen again** :D
- 5). You are eligible in MEGA MAHARATHI if you have given **more than 8 TESTS** out of the **11 TESTS** occurring throughout the batch i.e July-Oct. and **not on marks or any other factor**.
- 6). All the tests need to be attempted till the midnight (Tuesday).
- 7). You will have to attempt all tests genuinely and completely to be eligible for any scheme. We will use our Fraud check algorithms before identifying the award winners.

Thank - You

